1,155,521

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,155,521

Date of Application and filing Complete Specification: 30 June, 1966.
No. 29529/66.
Application made in Germany (No. S97909 IVc/22i) on 30 June, 1965.
Complete Specification Published: 18 June, 1969.

Index at acceptance: —**C3** R(19A, 19C2A, 19C3, 19C6AX, 19C22, 19C32, 19C33B, 19C33X, 19L2CX, 19L5A, 19L6A, 19L6B, 21A, 21C2A, 21C3, 21C6AX, 21C22, 21C32, 21C33B, 21C33X, 21L2CX, 21L5A, 21L6A, 21L6B); **C1** AK4; **C3** N(1F3, 1Q5, 1QX); **C3** U(2AX, 10D, 12B1A6B, 12B1B2, 12B2X)

Int. Cl.: —**C08 h 13/02**

COMPLETE SPECIFICATION

Plastic, Carbonaceous, Synthetic Resin Cement

We, SIGRI ELEKTROGRAPHIT GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, formerly, Siemens-Planiawerke Aktiengesellschaft für Kohlefabrikate, of Werner-von-Siemens Strasse 18, Meitingen, Near Augsburg, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a carbonaceous cement, suitable for use in a nipple junction of two carbon electrodes.

It is known to operate electric steel smelting furnaces using graphite, or other carbon, electrodes which are gradually consumed during smelting. For continuous operation the carbon electrodes are replenished from time to time by attaching new electrode parts thereto. Generally, the electrode parts are joined by a screw nipple which engages respectively threaded sockets in the electrode parts. Conventionally, the nipple junction is made secure by cementing. Normally the cement used for this purpose carbonizes when heated. There are several ways of placing the cement onto the junction components. One way is to brush the cement onto the nipple and the adjacent electrode parts while the junction is being made. Another way is to place cement in the form of pitch, shaped as a pin, into cavities of the nipple. When the carbon electrode is heated during operation, the pitch will drain from the cavities and penetrate between the screw threads on the nipple and in the sockets of the electrode parts, thus cementing them together. In many cases, however, the strength of a nipple junction secured with the aid of a pitch pin is insufficient. This particularly applies when temperatures below 400°C are used, at which cementing with pitch causes no appreciable strengthening of the nipple junction

It is further known to employ carbonaceous cement consisting of synthetic resin with an addition of carbon filler material. Such a cement, however, is not suitable for use in the shape of a pin. If the proportion of filler substance is too large, the pin remains rigid and does not drain from the nipple cavities into and between the screw threads. If a smaller proportion of filler material is used, the cement becomes too soft or fluid and hence cannot be pressed into suitably shaped pins.

According to the present invention there is provided a carbonaceous cement, suitable for use in a nipple junction between two carbon electrodes, comprising a mixture of a liquid which on heating forms a hardenable synthetic resin pitch, carbon filler material and a dextrin, the mixture having a plastic consistency, so that it may be pressed into the shape of a pin.

Preferably, the cement comprises from 25 to 60% of pitch, from 5 to 25% of dextrin, from 20 to 30% of the liquid component and from 10 to 40% carbon filler material, all percentages being by weight. Very good results have been obtained with a cement mixture of from 30 to 40% of pitch, from 20 to 30% of the liquid component, from 10 to 20% dextrin and from 20 to 30% of carbon filler material. Preferably the pitch used has a melting point (according to Kramer-Sarnow) of from 120 to 180°C, more particularly from 140 to 160°C. Preferably the liquid component employed is one which forms on heating a thermosetting resin and, more particularly, is a liquid, having a viscosity at

[*Price 4s. 6d.*]

20°C. of from 50 to 500 cP, preferably a viscosity at 20°C of 50 to 150cP.

A particularly preferred liquid which on heating forms a hardenable synthetic resin, and that which was used in the Examples, given hereinafter, is a condensation product obtained by the alkaline condensation of furfural and at least one aliphatic aldehyde containing a $-CH_2-$ group in the α-position to the aldehyde group, as described in Specification No. 876,087. Any of the liquid condensation products of said specification and any other liquids which on heating form hardenable synthetic resins are suitable for use in the cement of this invention.

The carbon filler material of the cement preferably comprises coke dust, particularly of a maximum grain size below 60 micron.

The cement mixture according to the invention can be readily fabricated, for example, with the aid of an extrusion press, to the shape of a strand that can be cut into pins. These cement pins can be accommodated in corresponding bores or other recesses of the electrode nipples. However, the cement may also be pressed as a shapeless mass into the nipple bores. The consistency of the cement is such that it remains solid and retains its shape during storage and will not drain from the nipple bores at normal room temperature. Only when the cement is heated will it become fluid and then drain out of the nipple bores and fill the interstices between the screw threads of the nipple and the electroc sockets. Particularly when a liquid which forms a thermosetting synthetic resin is used, the cement according to the invention, while avoiding the addition of a hardener, has a virtually unlimited shelf life. The cement further achieves a considerably better adhesive strength within the nipple junction in comparison with the pitch pins heretofore known for such purposes.

The invention thus provides a cement for reliably locking a nipple and socket junction between two carbon electrodes, that avoids the shortcomings of the cement materials heretofore available. More particularly, the invention provides a cement composition for the just-mentioned purpose which assures preserving the desired reliability of the nipple junction even at relatively low operating temperatures, such as 400°C or even less, and which can be readily pressed into the shape of pins suitable to withstand the manipulation required for inserting them into cavities of the nipples, while nevertheless draining from these cavities into the interstices between the threads on the nipple and the electrode sockets when the junction is subjected to elevated temperatures.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the single Figure of the accompanying drawing, which shows a nipple junction of two carbon electrodes.

The figure shows in diametrical section, the connection between an upper electrode portion 1 and a lower electrode portion 2. The two portions are joined by a double conical screw nipple 3 in threaded engagement with the interior screw thread of respective sockets in the butt ends of the electrode portions. The upper and lower portion of the nipple 3 are provided with respective horizontal bores 4 and 5 extending diametrically through the nipple body. Inserted into the bores 4 and 5 are respective pins 6 and 7 consisting of the cement according to the invention. When the junction area of the electrode assembly has been heated due to the operation of the assembly, the cement becomes fluid and flows out of the bores into spaces remaining in screw threads 8 between nipple 3 and the electrode sockets. During further heating, the cement in these interspaces is disassociated and carbonized, thus forming a solid and rigid bond which reliably locks the nipple junction.

The following Examples illustrates the invention, all percentages being by weight unless otherwise stated. In the Examples, the liquid used was a furfuryl-acrolein condensation product obtained according to the procedure of Example 1 of Specification No. 876,087 prior to the addition of the dicyclopentadiene.

Example 1

A cement mixture was prepared from 30.5% of pitch having a solidification point between 160 and 170°C and a coke content of 60%. The pitch was mixed with 20% of a furfuryl-acrolein condensation product according to Example 1 of Specification No. 876,087. 30.5% coke dust having a maximum grain diameter of 60 micron, and 13% dextrin. This cement mixture was shaped into pins which were inserted into two radial bores fully traversing a nipple and each having a diameter of 9 mm. The nipples thus prepared were employed for joining electrode portions of dimension 180×150 mm. The nipple junction was then heated to different testing temperatures, and the strength of the nipple junction was measured at the different temperature by attempts to separate the junction by twisting. The following values were thus measured. At 200°C, 20 mkg i.e. meter-kilograms; at 300°C, 36 to 46 mkg; at 400°C, more than 50 mkg; and at 500°C, more than 50 mkg.

Example 2

A cement mixture was prepared from 33.3% pitch having a solidifying point of 160 to 170°C, 28.6% of a furfuryl-acrolein condensation product according to Example 1 of Specification No. 876,087, 23.8% coke dust having a maximum grain size below 60 micron, and 14.3% dextrin. The strength of

the nipple junction was measured as described in Example 1, and the results were substantially identical with those give in Example 1.

EXAMPLE 3

A cement mixture was prepared from 35% pitch having a solidfication point between 160 and 170°C, 30% of a furfuryl-acrolein condensation product according to Example 1 of Specification No. 876,087, 20% coke dust having a maximum grain size below 60 micron, and 15% dextrin. The mixture was more brittle than those made in Example 1 and 2 but exhibited substantially the same strength as the nipples made in Examples 1 and 2.

EXAMPLE 4

A cement mixture was prepared from 58% pitch having a solidification point between 160 and 170°C, 21% of a furfuryl-acrolein condensation product according to Example 1 of Specification No. 876,087, 16% coke dust, and 5% dextrin. The following values of strength were measured in twisting tests carried out as described in Example 1: at 200°C, 16 to 17mkg; at 300°C, 16 to 17 mkg; at 400°C, 23 to 25 mkg; and at 500°C, more than 50 mkg.

The tests made in the foregoing Examples showed that the cement according to the invention effectively locks the nipple junction at relatively low temperatures, for example 300°C, and that this locking effect remains preserved after complete carbonization of the cement at about 500°C.

WHAT WE CLAIM IS:—

1. A carbonaceous cement, suitable for use in a nipple junction between two carbon electrodes, comprising a mixture of a liquid which on heating forms a hardenable synthetic resin, pitch, carbon filler material and a dextrin, the mixture having a plastic consistency, so that it may be pressed into the shape of a pin.

2. A cement according to Claim 1, wherein the mixture comprises from 20 to 30 weight percent of the liquid component, from 25 to 60 weight percent of pitch, from 10 to 40 weight percent of carbon filler material, and from 5 to 25 weight percent of dextrin.

3. A cement according to Claim 2, wherein the mixture comprises from 20 to 30 weight percent of the liquid component, from 30 to 40 weight percent of pitch, from 20 to 30% weight percent of carbon filler material, and from 10 to 20% weight percent of dextrin.

4. A cement according to any preceding claim, wherein the melting point of the pitch (according to the Kramer-Sarnow method) is from 120 to 180°C.

5. A cement according to Claim 4, wherein the melting point of the pitch is from 140 to 160°C.

6. A cement according to any preceding claim, wherein the resin formed by the said liquid is a thermosetting resin.

7. A cement according to any preceding claim, wherein the liquid is a condensation product of furfuryl alcohol and acrolein.

8. A cement according to any preceding claim, wherein the viscosity of the liquid at 20°C. is from 50 to 500cP.

9. A cement according to Claim 8, wherein the viscosity of the liquid at 20°C. is from 50 to 150 cP.

10. A cement according to any preceding claim, wherein the carbon filler material is coke dust.

11. A carbonaceous cement according to Claim 1, substantially as described with reference to any foregoing Example.

12. A method of producing cement pins, suitable for use in a nipple junction between two carbon electrodes, which comprises extruding a strand of a cement as claimed in any preceding claim, and dividing the strand into cement pins.

13. A method according to Claim 12 of producing cement pins, substantially as described in foregoing Example 1.

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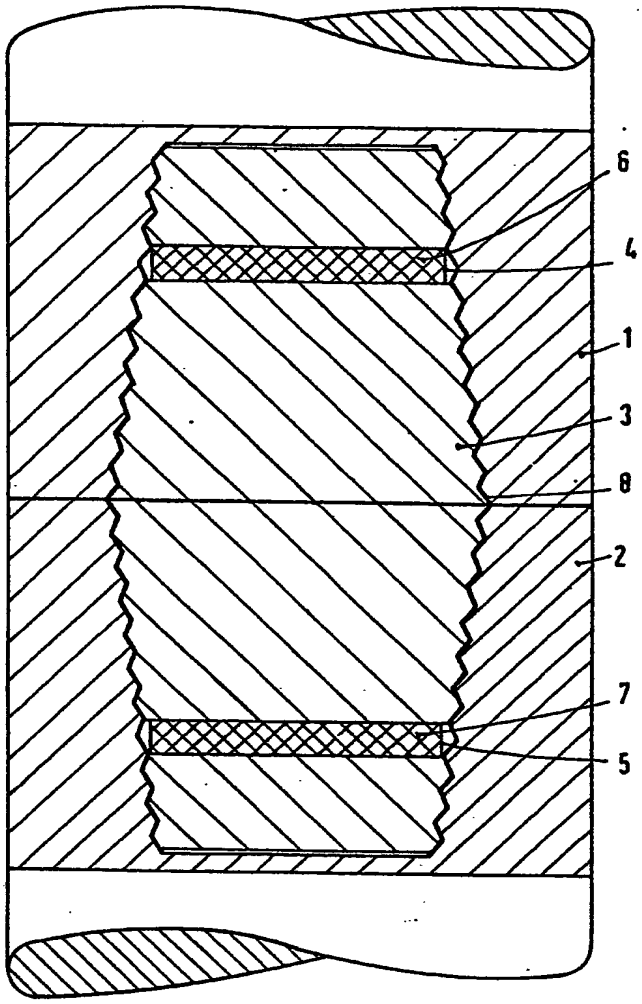
Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1969.
Published by the Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

1155521 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*



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